

What is claimed is:

1. A fuel vapor management apparatus for an internal combustion engine, comprising:
a housing located upstream of an intake manifold, canister and purge valve and downstream of a vent port, the housing defining an interior chamber and a valve separating the interior chamber into first and second portions; and
a device including a temperature sensor disposed within the chamber, the device being configured to detect fuel vapor flow based upon a temperature detected by the sensor.
2. The apparatus of claim 1, wherein the device detects fuel vapor flow based upon a detected change in temperature.
3. The apparatus of claim 2, wherein the device includes a thermistor.
4. The apparatus of claim 3, wherein the device includes a resistor thermally coupled with the thermistor.
5. The apparatus of claim 1, wherein the valve is actuated by forces originating from a change in pressure between the first and second portions.
6. The apparatus of claim 1, wherein the valve is a pressure operable valve.
7. The apparatus of claim 1, wherein the sensor resides on a circuit board and the circuit board includes a pressure sensor.
8. The apparatus of claim 7, wherein the circuit board is disposed in the first portion and the first portion is in continuous fluid communication with the canister.
9. The apparatus of claim 1, wherein the device calculates a flow rate.

10. The apparatus of claim 1, wherein the device has a first and second configuration, the first configuration including an enabled heating element and the second configuration including a disabled heating element.

11. The apparatus of claim 1, further including :
a pressure operable device comprising the valve;
the sensor is disposed in the first portion; and
the first portion is in continuous fluid communication with a fuel vapor collection canister and the second portion is periodically in fluid communication with the canister.

12. The apparatus of claim 11, wherein the pressure operable device further includes:
a poppet movable along an axis and a seal adapted to cooperatively engage the poppet, wherein a first arrangement of the pressure operable device occurs when there is a first negative pressure level in the fuel vapor collection canister relative to the vent port and the seal is in a first deformed configuration, a second arrangement of the pressure operable device permits a first fluid flow from the vent port to the fuel vapor collection canister when the seal is in a second deformed configuration, and a third arrangement of the pressure operable device permits a second fluid flow from the fuel vapor collection canister to the vent port when the seal is in an un-deformed configuration, and wherein the pressure sensor signals the first arrangement of the pressure operable device.

13. The apparatus of claim 12, wherein the poppet is configured to move along an axis between a first position, a second position, and an intermediate position between the first and second positions.

14. The apparatus of claim 13, wherein the first and second arrangements of the pressure operable device comprise the poppet in the second position, and the third arrangement of the pressure operable device comprise the poppet in the first position.

15. The apparatus of claim 14, wherein a spring biases the poppet towards the second position.

16. A fuel vapor pressure and flow apparatus of a fuel system supplying fuel to an internal combustion engine, comprising:

a housing defining an interior chamber, the housing being located upstream of an intake manifold, canister and purge valve and downstream of a vent port;

a valve separating the interior chamber into first and second portions, the first portion adapted for being continuously exposed to fuel vapor and the second portion adapted for being periodically exposed to fuel vapor;

a pressure sensor located within the interior chamber; and

a flow sensor located within the interior chamber, the flow sensor including a thermistor.

17. The apparatus of claim 16, wherein the flow sensor includes a heating element.

18. The apparatus of claim 17, wherein the heating element is a resistor.

19. The apparatus of claim 18, wherein the thermistor and resistor are thermally bonded using one of epoxy and placing the thermistor on the resistor.

20. The apparatus of claim 18, wherein the resistor is one of conductive ink and a resistive gold leaf.

21. The apparatus of claim 16, wherein the thermistor and heating element are located in the first portion.

22. The apparatus of claim 16, further including :

a pressure operable device comprising the valve;

the flow sensor is disposed in the first portion; and

the first portion is in continuous fluid communication with a fuel vapor collection canister and the second portion is in continuous fluid communication with a vent port.

23. The apparatus of claim 22, wherein the pressure operable device further includes:
a poppet movable along an axis and a seal adapted to cooperatively engage the poppet, wherein a first arrangement of the pressure operable device occurs when there is a first negative pressure level in the fuel vapor collection canister relative to the vent port and the seal is in a first deformed configuration, a second arrangement of the pressure operable device permits a first fluid flow from the vent port to the fuel vapor collection canister when the seal is in a second deformed configuration, and a third arrangement of the pressure operable device permits a second fluid flow from the fuel vapor collection canister to the vent port when the seal is in an un-deformed configuration, and wherein the pressure sensor signals the first arrangement of the pressure operable device.
24. A method for diagnosing a purge valve of a fuel vapor pressure management system of an internal combustion engine, comprising the steps of :
heating a temperature sensor, the sensor being located upstream of an intake manifold, canister and purge valve and downstream of a vent port; and
detecting fuel vapor flow using the temperature sensor and determining, based on the detected fuel vapor flow, whether the purge valve is purging fuel vapor.
25. The method of claim 24, wherein the detecting fuel vapor flow further includes detecting a rate of change in temperature using the temperature sensor.
26. The method of claim 24, further comprising the step of opening the purge valve, wherein the heating step occurs before the opening of the purge valve.
27. The method of claim 26, further comprising the step of opening the purge valve, wherein the heating step occurs after the opening of the purge valve.
28. The method of claim 24, further including the step of measuring an initial plurality of temperatures of the sensor before detecting a fuel vapor flow.

29. The method claim 24, further including the step of measuring a plurality of temperatures using the sensor wherein the initial measured temperature is greater than the final measured temperature.

30. The method claim 24, further including the step of measuring a plurality of temperatures using the sensor wherein the initial measured temperature is less than the final measured temperature.

31. The method of claim 24, further including the steps of :
opening the purge valve, and
synchronizing the opening of the purge valve step with the heating step.

32. The method of claim 24, further including the step of:
providing a housing defining an interior chamber, the chamber containing a valve separating the chamber into a first portion and second portion; and
positioning the temperature sensor in one of the first and second portions.

33. The method of claim 32, further including the steps of :
using a pressure operable device comprising the valve;
locating the temperature sensor in the first portion; and
providing the first portion in continuous fluid communication with a fuel vapor collection canister and the second portion in continuous fluid communication with a vent port.

34. The method of claim 33, wherein the providing step further includes :
providing a poppet movable along an axis and a seal adapted to cooperatively engage the poppet as the pressure operable device, wherein a first arrangement of the pressure operable device occurs when there is a first negative pressure level in the fuel vapor collection canister relative to the vent port and the seal is in a first deformed configuration, a second arrangement of the pressure operable device permits a first fluid flow from the vent port to the fuel vapor collection canister when the seal is in a second deformed configuration,

and a third arrangement of the pressure operable device permits a second fluid flow from the fuel vapor collection canister to the vent port when the seal is in an un-deformed configuration, and the pressure sensor signals the first arrangement of the pressure operable device.

35. The method of claim 34, further including the step of orientating the poppet so that it is movable along an axis between a first position, a second position, and an intermediate position between the first and second positions.

36. The method of claim 35, wherein the first and second arrangements of the pressure operable device comprise the poppet in the second position, and the third arrangement of the pressure operable device comprises the poppet in the first position.

37. The method of claim 36, wherein a spring biases the poppet towards the second position.

38. A method for diagnosing a purge valve of a fuel system for an internal combustion engine, wherein the purge valve is upstream of the engine intake manifold and a fuel vapor collection canister is upstream of the purge valve, the purge valve being controlled by the ECU, comprising the steps of:

- providing a housing upstream of the canister and downstream of an external air intake, the housing containing a valve and a temperature sensor controlled by the ECU;

- sending a command to the purge valve;

- sending a command to heat the temperature sensor; and

- measuring a plurality of temperatures using the temperature sensor and, based on the plurality of temperatures, determining a flow rate within the housing indicative of an open purge valve.

39. The method of claim 38, wherein the sending a command to heat the temperature sensor occurs before the sending a command to the purge valve.

40. The method of claim 38, further including the step of monitoring the temperature reported by the temperature sensor before opening the purge valve.